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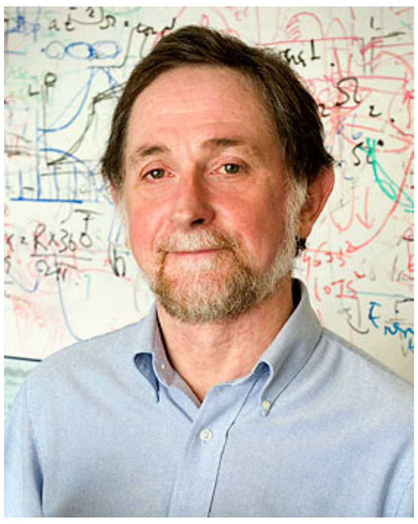

Peter D. Johnson
Condensed Matter Physics and Materials Science Department
Brookhaven National Laboratory

Shining a light on High Tc Superconductivity

Tuesday, October 18, 2016
2:30 - 3:30pm
Sig Hecker Conference Room (TA3 - 0032 room 134)

Abstract: Photoemission has developed into a powerful probe of condensed matter. Modern technical developments enable the study of not only the single particle spectra but also the interaction with collective excitations. In this talk we present an overview of the modern photoemission experiment followed by demonstrations of its application to the high Tc cuprate superconductors. We discuss insights into the complex phase diagram of the latter materials offered from photoemission studies. We show that in the underdoped pseudogap regime the Fermi surface is characterized by pockets and that these pockets evolve into a large Fermi surface beyond a critical doping of 0.2. The latter transition representing a transition from a doped Mott Insulator to more metallic like behavior. However the overdoped regime is also characterized by superconducting fluctuations resulting in a gap still evident in the spectra at temperatures above Tc. Careful investigation of the latter phenomena allow us to reveal a clear link between the pseudogap state at high temperatures and the superconducting state at low temperatures. A refinement of the photoemission technique, pump-probe or two photon photoemission, is used to further investigate the character of the Fermi surface and the dynamics of these materials. By using ultrafast photo-doping and examining the system in non-equilibrium we are able to confirm the presence of hole pockets in the underdoped region of the phase diagram. The pump-probe technique also allows us to explore the unoccupied states above the Fermi level where we identify scattering from a mode, reminiscent of a well studied kink and associated mass renormalization, observed below the Fermi level.

Bio: Peter Johnson is an internationally recognized physicist working in the area of Condensed Matter Physics and specializing in the use of photoelectron spectroscopy, a process in which an electron absorbs energy from light and is ejected from the material under study, thus revealing information about the properties of the electron before excitation. In recent years Johnson has focused on studies of strongly correlated systems with a particular emphasis on the high Tc superconductors. materials in which electrons are confined to two dimensions, rather than the usual three dimensions.

After earning a Ph.D. in physics from Warwick University in the UK in 1978, Johnson worked for Bell Laboratories, and then joined Brookhaven Lab in 1982. He rose through the ranks to become a senior physicist in 2000, and became Associate Chair of Brookhaven's Physics Department in 2003. Johnson was appointed Deputy Chair of the Condensed Matter Physics & Materials Science Department upon its founding in April 2006. In June 2007, he became Chair of the department and remained in that position until the end of 2016. He currently leads the department's electron spectroscopy research group and is also the Director of the Center for Emergent Superconductivity, an Energy Frontier Research Center.

A recipient of the American Physical Society's Oliver E. Buckley Prize in 2011 and Brookhaven Lab's Science and Technology Award in 2001, Johnson is a Fellow of the American Association for the Advancement of Science, the American Physical Society and the Institute of Physics in the United Kingdom. He is the author of more than 180 peer-reviewed scientific papers and six book chapters.

For general information contact Caryll Blount - IMS Professional Staff Assistant
caryll@lanl.gov * 665-3950

Hosted by Alexander Balatsky * Director of the Institute for Materials Science

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